Snowmass 2001

Chris Quigg
DPF / Fermilab

High Energy Physics Advisory Panel

NSF · Arlington, Virginia · October 30, 2001

Three weeks of intense work

organized by APS DPF & DPB

More than 1200 participants . . .

More than 80 students . . .

More than 200 “young” . . .

More than 200 from outside US . . .

Thanks!

DOE · NSF · NASA

DPF · DPB · IEEE / NPSS

Argonne National Lab

Berkeley Lab

Brookhaven National Lab / Brookhaven Science Associates

Cornell University / LNS / Wilson Synchrotron Lab

Fermilab / Universities Research Association

Jefferson Laboratory / SURA

Lawrence Livermore National Laboratory

Los Alamos National Laboratory

Oak Ridge National Lab / Spallation Neutron Source

Stanford Linear Accelerator Center / Stanford University

Thanks to the Organizing Committee

Particle Physics

Chris Quigg (DPF)
Sally Dawson (BNL)
Paul Grannis (Stony Brook)
David Gross (ITP/UCSB)
Joe Lykken (Fermilab)
Hitoshi Murayama (Berkeley)
René Ong (UCLA)
Natalie Roe (LBNL)
Heidi Schellman (Northwestern)
Maria Spiropulu (Chicago)

Accelerators & Technology

Ron Davidson (DPB; PPPL)
Alex Chao (SLAC)
Alex Dragt (Maryland)
Gerry Dugan (Cornell)
Norbert Holtkamp (SNS)
Chan Joshi (UCLA)
Thomas Roser (BNL)
Ron Ruth (SLAC)
John Seeman (SLAC)
Jim Strait (Fermilab)

and the Convenors of 27 working groups

Thanks!

IEEE/NPSS Committee for Technology Emphasis

Bruce C. Brown, Matthew A. Allen, William M. Bugg, Peter Clout, John E. Elias, Erik Heijne, Thomas Katsouleas, Ray S. Larsen, Patrick Le Du, Alan Todd, Craig L. Woody

Thanks to the 38 presenters of lectures and courses!

Follow the NPSS link at http://snowmass2001.org

Thanks!

to more than 200 participants from abroad

and especially laboratory directors

Alessandro Bettini (Gran Sasso), Luciano Maiani (CERN),
Alexander Skrinksky (Novosibirsk), Hirotaka Sugawara, (KEK),
Albrecht Wagner, (DESY)

and

Ian Corbett (GSF), Lorenzo Foà (ECFA),
Ferdi Willeke (ICFA/GAN), Satoru Yamashita (Japan HEP)

Thanks!

Snowmass 2001 Outreach Coordinating Committee

Elizabeth Simmons, Marge Bardeen, Martin Berz, Bill Frazer,
Evalyn Gates, Joey Huston, Ronen Mir, Mel Month, Helen Quinn,
Deborah Roudebush, Greg Snow, Ken Taylor, Jeff Wilkes; Melissa Clayton

http://smyrd.bu.edu/hepap-talk/ & http://smyrd.bu.edu/rpm-lbl/

Wonderful Things Happened at Snowmass 2001

- We rediscovered our community and our sense of common destiny.
  Breadth . . . excellence . . . global reach . . . optimism . . . youth . . .

  Special thanks to our Astro/Cosmo/Particle colleagues

- We celebrated the astonishing progress and remarkable promise of particle physics, broadly understood.
  No one should miss the conclusion that ours is a community on the move, worldwide.

- We took pleasure in the inventiveness and careful thought of our colleagues who dream, design, and build accelerators and the components that make them possible.

- We mixed: T working groups; the example of Tor and Reinhard . . .

- We engaged with each other's aspirations and significantly advanced a number of ideas.

Wonderful Things . . .

- We planted many seeds: teach-ins on Accelerator R&D and on Astro/Cosmo/Particle opportunities
- We received excellent coverage in the scientific and popular press. A number of excellent reporters and science writers spent time at Snowmass. They saw a vibrant community in action and met many of our interesting colleagues.
  (Handout of press clips through end of July)
  Example: "To Be Young and in Search of the Higgs Boson"
- At Snowmass, we saw much excellent work and many constructive interactions; we'll soon have the formal record of the Proceedings (thanks to SLAC).
  This is only the beginning: We will be harvesting the fruits of Snowmass for many years.

Some Goals for Snowmass 2001

▷ Survey our aspirations for particle physics over 30 years.

Quarks Unbound, DPF's illustrated survey of grand themes

Written by *Sharon Butler* with guidance from DPF members of the Snowmass Organizing Committee, based on her interviews and discussions with many members of the US particle physics community.

We owe a special debt of gratitude to Joe Lykken and Maria Spiropulu for their dedication to the project.

DPF has funded the creation of *Quarks Unbound,* and produced 20,000 copies for distribution to DPF members, APS officers, physics department chairs, funding agencies, Congress, science writers, and other opinion leaders. We are seeking support to distribute a copy to every high school physics teacher.

Some Goals for Snowmass 2001

- ▷ Survey our aspirations for particle physics over 30 years.

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- ▷ Assess the current state of development of accelerator protoprojects and advanced accelerator research, and understand the investment we must make (financial and human capital) to bring the most promising lines to maturity.

  DPB's Snowmass Accelerator R&D Report (Alex Chao's talk)

- ▷ Look beyond our immediate goals for measurements and searches to contemplate the shape of a more complete, more ambitious theoretical framework. How should theoretical vision shape our experimental goals?

- ▷ Examine the importance of scale diversity for a healthy and productive future.

- ▷ Educate ourselves about the full range of possibilities before us.

  We must know enough to judge critically, to improve the arguments, to articulate our goals effectively. HMOs in E1 – E6.

- ▷ Listen carefully to our young colleagues, who will help create our common futures.

  Young Physicists Forum (Much information at http://ypp.hep.net)

- ▷ Take advantage of opportunities to interact with the HEPAP Subpanel.

  Technical work carried out at Snowmass will undergird the recommendations the subpanel makes.

- ▷ Consider the international dimensions of what we hope to achieve.

  International lab directors
  Global Accelerator Network Discussion
  Reports from ECFA and Japan HEP Planning Committees

- I believe we must articulate a comprehensive vision of particle physics (and the sciences it touches) to make our case effectively to ourselves, to other scientists, and to society at large.

  At the same time, we have a special responsibility to examine the prospects for the most ambitious accelerators, which are major drivers of our scientific progress.

  If we judge the science to be rich, and if we can make the cost and technical risk attractive, we will want to pursue all the leading possibilities: linear colliders, hadron colliders reaching far beyond the TeV scale, muon storage ring, and muon collider.

  The vision we present should include the scientific promise of all these instruments, and a strategy for deciding what, where, and when that includes the organic R&D investment we will need to evolve the right set of instruments to serve our science.

- Thanks to the work of many people, the moment is upon us to probe, shape, and judge the idea of a linear collider as a possible next big step for particle physics.

  Evaluating a linear collider and working to define a scientifically rich, technically sound, fiscally responsible plan is a homework problem for the entire community.

  Everyone must come to an informed judgment.

▷ Thanks to the work of many people, the moment is upon us to probe, shape, and judge the idea of a linear collider as a possible next big step for particle physics.

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Everyone must come to an informed judgment.

At Snowmass 2001, a widespread feeling has emerged that the world community should move urgently to construct a TeV-scale linear collider as an international project.

These are ambitious machines and significant challenges remain: we must be certain of the costs and we must take the measure of technical risks. A phase change is needed to complete the design and development promptly.

In the United States, another phase change is needed *soon* in the commitment of experimental physicists to the linear collider program.

A few people have done valuable work, but outside the US, *many more people* have done much more comprehensive work.

US participation in a linear collider will not be decisive without the engagement of a large and energetic cadre of superb experimenters to hone the physics case, participate in parameter choices, and work side-by-side with the machine builders. *If you wait, it will not happen!*

It is also time for closer cooperation among physicists in different regions on linear collider issues: to coordinate R&D, to develop a unified physics document, and to make the scientific case to the governments of the world—perhaps an International Linear Collider Users Group?

When you go home . . .

- ▷ Continue to think about what you have heard and done at Snowmass.
- ▷ Talk with your particle physics colleagues about what you have seen and heard and done here. Arrange seminars to share the Snowmass 2001 experience with all your students and colleagues.
- ▷ Talk with your colleagues in other fields of physics and astronomy about Snowmass 2001. Share your enthusiasm! Give a colloquium early in the school year about the future of particle physics.
- ▷ Talk with your colleagues in other fields about their excitement and aspirations. Help your students appreciate the exciting futures all across physics and astronomy.

Opposite: Analyzing data taken from a cathedral-size neutrino detector buried under the mountains of Japan, physicists traced the particles back to their origins in space and created this map of the sky. By far, the largest concentration of neutrinos (white) came from the Sun. Credit: Institute for Cosmic Ray Research, University of Tokyo

IF WE COULD TURN OFF ALL THE LIGHTS IN THE UNIVERSE AND LET NEUTRINOS SHINE, WE'D FIND THAT THE SUN IS STILL THE BRIGHTEST ORB IN OUR SKY. ■ THAT'S WHY THE STUDY OF THE FUNDAMENTAL PARTICLES OF MATTER FASCINATES: BECAUSE WE SEE OUR WORLD ANEW, IN WAYS WE BARELY IMAGINED. WE LEARN HOW MATTER IS PUT TOGETHER, HOW IT BEGAN, AND HOW IT EVOLVES. WE CONNECT THE FAMILIAR WITH THE EXOTIC, THE COSMIC WITH THE EVERYDAY. ■ PARTICLE PHYSICS ENGAGES BECAUSE WE NEVER STOP ASKING HOW AND WHY.